EXERCISE METHODS AND APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application discloses subject matter entitled to the earlier filing date of U.S. Provisional Application Ser. No. 60/044,026, filed on May 5, 1997.

FIELD OF THE INVENTION

The present invention relates to exercise methods and apparatus and more particularly, to exercise equipment which facilitates exercise through a curved path of motion.

BACKGROUND OF THE INVENTION

Exercise equipment has been designed to facilitate a variety of exercise motions. For example, treadmills allow a person to walk or run in place; stepper machines allow a person to climb in place; bicycle machines allow a person to pedal in place; and other machines allow a person to skate and/or stride in place. Yet another type of exercise equipment has been designed to facilitate relatively more complicated exercise motions and/or to better simulate real life activity. Such equipment typically uses some sort of linkage assembly to convert a relatively simple motion, such as circular, into a relatively more complex motion, such as elliptical. One example of such equipment may be found in U.S. Pat. No. 3,316,898 to Brown. Subsequent advances in the art have facilitated additional foot motions and/or added upper body exercise, but room remains for additional improvements to machines of this type.

SUMMARY OF THE INVENTION

The present invention may be seen to provide a novel linkage assembly and corresponding exercise apparatus suitable for linking circular motion to relatively more complex, generally elliptical motion. In at least one embodiment, a first end of a foot supporting member is rotatably connected to a crank, and a second, opposite end of the foot supporting member is supported by a roller which is selectively movable in a radial direction. The arrangement is such that rotation of the crank is linked to generally elliptical motion of an intermediate portion of the foot supporting member, and the motion is variable in response to radial movement of the roller.

In another respect, the present invention may be seen to provide a novel linkage assembly and corresponding exercise apparatus suitable for linking reciprocal motion to relatively more complex, generally elliptical motion. In at least one embodiment, the forward end of the foot supporting member is connected to a lower end of a rocker link having an upper end which is sized and configured for grasping. The arrangement is such that generally elliptical motion of the intermediate portion of the foot supporting member is linked to pivoting of the rocker link.

In yet another respect, the present invention may be seen to provide a novel linkage assembly and corresponding exercise apparatus suitable for adjusting the angle of the generally elliptical path of motion relative to a horizontal surface on which the apparatus rests. In at least one embodiment, the roller is movable up and down relative to the crank axis to change the inclination of the generally elliptical path of motion. Many of the advantages of the present invention may become more apparent from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWING

With reference to the Figures of the Drawing, wherein like numerals represent like parts and assemblies throughout the several views,

FIG. 1 is a side view of a first exercise apparatus constructed according to the principles of the present invention;

FIG. 2 is a side view of a second exercise apparatus constructed according to the principles of the present invention;

FIG. 3 is a side view of a third exercise apparatus constructed according to the principles of the present invention;

FIG. 4 is a side view of a fourth exercise apparatus constructed according to the principles of the present invention; and

FIG. 5 is a side view of a fifth exercise apparatus constructed according to the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Several embodiments of the present invention are described below with reference to the accompanying drawings. On each embodiment, a linkage assembly moves relative to a frame in a manner that links rotation of a crank to generally elliptical motion of a foot supporting member. The term "elliptical motion" is intended in a broad sense to describe a closed path of motion having a relatively longer first axis and a relatively shorter second axis (which extends perpendicular to the first axis).

Each frame includes a base which may be described as generally I-shaped and designed to rest upon a generally horizontal floor surface. Each apparatus is generally symmetrical about a vertical plane extending lengthwise through the base (perpendicular to the transverse members at each end thereof), the only exception being the relative orientation of linkage assembly components on opposite sides of the plane of symmetry. In general, the "right-hand" components are one hundred and eighty degrees out of phase relative to the "left-hand" components. However, like reference numerals are used to designate both the "right-hand" and "left-hand" parts, and when reference is made to one or more parts on only one side of an apparatus, it is to be understood that corresponding part(s) are disposed on the opposite side of the apparatus. Also, the portions of the frame which are intersected by the plane of symmetry exist individually and thus, do not have any "opposite side" counterparts. Moreover, to the extent that reference is made to forward or rearward portions, it is to be understood that a person could exercise while facing in either direction relative to the linkage assembly.

A first exercise apparatus constructed according to the principles of the present invention is designated as **100** in FIG. 1. The apparatus has a frame **110** which includes an I-shaped base **112**; a forward stanchion or upright **115** which extends upward from the base **112** proximate a first end **113** thereof; and a rearward stanchion or upright **116** which extends upward from the base **112** proximate a second, opposite end **114** thereof.

Left and right flywheels **120** are rotatably mounted on opposite sides of the rearward stanchion **116** and rotate together about a common crank axis **126**. Those skilled in the art will recognize that the flywheels **120** may be connected to a conventional resistance device or replaced by some other rotating member(s) which may or may not, in turn, be connected to one or more flywheels and/or a conventional resistance device.

Left and right foot supporting members **140** have rear ends which are rotatably connected to radially displaced

portions of respective cranks **120**, thereby defining rotational axes **142**. The rotational axes **142** are constrained to rotate about the crank axis **126** and thereby define fixed crank radii.

An intermediate portion of each foot supporting member **140** is sized and configured to support a respective foot of a standing person. A forward end of each foot supporting member **140** is supported by a respective roller **150** which rotates relative to the frame **110**. More specifically, an adjustable length member **155** is rigidly mounted on the forward stanchion **115**, and the rollers **150** are rotatably mounted on a selectively movable portion of the adjustable length member **155**. When the roller **150** occupies the position shown in solid lines in FIG. **1**, rotation of the crank **120** is linked to movement of a person's feet move through the generally elliptical path designated as P.

A user accessible device **160** is mounted on top of the forward stanchion **115** to provide information regarding and/or facilitate adjustment of exercise parameters. For example, a button **165** may be depressed to change the length of the adjustable length member **155** and thereby reposition the rollers **150** relative to the crank axis **126**. As suggested by the roller **150'** and path P' shown in dashed lines in FIG. **1**, relatively higher rollers results in a relatively more "uphill" exercise.

A second exercise apparatus constructed according to the principles of the present invention is designated as **200** in FIG. **2**. The apparatus has a frame **210** which includes an I-shaped base **212**; a forward stanchion or upright **215** which extends upward from the base **212** proximate a first end **213** thereof; and a rearward stanchion or upright **216** which extends upward from the base **212** proximate a second, opposite end **214** thereof.

Left and right flywheels **220** are rotatably mounted on opposite sides of the rearward stanchion **216** and rotate together about a common crank axis **226**. Those skilled in the art will recognize that the flywheels **220** may be connected to a conventional resistance device or replaced by some other rotating member(s) which may or may not, in turn, be connected to one or more flywheels and/or a conventional resistance device.

Left and right foot supporting members **240** have rear ends which are rotatably connected to radially displaced portions of respective cranks **220**, thereby defining rotational axes **242**. The rotational axes **242** are constrained to rotate about the crank axis **226** and thereby define fixed crank radii.

An intermediate portion of each foot supporting member **240** is sized and configured to support a respective foot of a standing person. A forward end of each foot supporting member **240** is supported by a respective roller **250** which rotates relative to the frame **210**. Each roller **250** is a circular gear **250** having a geometric center **251** and gear teeth disposed about its circumference, and an eccentric portion of each roller **250** is rotatably mounted to the forward stanchion **215**, thereby defining rotational axes **255**. Mating rack gear teeth extend downward from the forward end of each foot supporting member **240** and engage the teeth on a respective gear **250**. The gear teeth prevent slippage of either foot supporting member relative to a respective roller **250**. The resulting foot path is designated as P2 in FIG. **2**. Inclination adjustment may be added as a matter of design choice.

A third exercise apparatus constructed according to the principles of the present invention is designated as **300** in FIG. **3**. The apparatus has a frame **310** which includes an

I-shaped base **312**; a forward stanchion or upright **315** which extends upward from the base **312** proximate a first end **313** thereof; and a rearward stanchion or upright **316** which extends upward from the base **312** proximate a second, opposite end **314** thereof.

Left and right flywheels **320** are rotatably mounted on opposite sides of the rearward stanchion **316** and rotate together about a common crank axis **326**. Those skilled in the art will recognize that the flywheels **320** may be connected to a conventional resistance device or replaced by some other rotating member(s) which may or may not, in turn, be connected to one or more flywheels and/or a conventional resistance device.

Left and right foot supporting members **340** have rear ends which are rotatably connected to radially displaced portions of respective cranks **320**, thereby defining rotational axes **342**. The rotational axes **342** are constrained to rotate about the crank axis **326** and thereby define fixed crank radii.

An intermediate portion of each foot supporting member **340** is sized and configured to support a respective foot of a standing person. A forward end of each foot supporting member **340** is supported by a respective roller **350** which is rotatably mounted on a lower end of a respective handle bar rocker link **370**. An intermediate portion of each rocker link **370** is rotatably connected to the forward stanchion **315**, and an upper end of each rocker link **370** is sized and configured for grasping.

The resulting assembly facilitates several different exercise modes or routines. In a first routine, for example, a user may maintain the handle bar rocker links **370** in a vertical orientation while moving his feet through fixed elliptical paths of motions. In a second routine, for example, a user may maintain the handle bar rocker links **370** in rearwardly tilted orientations while moving his feet through fixed elliptical paths of motion which are relatively more upwardly inclined. In a third routine, for example, a user may move the handle bar rocker links **370** while moving his feet through paths of motion which vary in accordance with the motion of the rocker links **370**.

The apparatus **300** may be modified in a variety of ways to facilitate additional exercise modes. For example, the rocker links **370** may be selectively pinned to the forward stanchion **315** to provide a stationary support which does not require physical exertion to remain in place. Also, the rocker links **370** may be selectively pinned in various orientations relative to the forward stanchion **315** to provide different handle orientations and inclinations of foot travel. Moreover, the rocker links **370** may be rigidly connected to one another so that they pivot together relative to the forward stanchion **315**. Furthermore, the rocker links **370** may be "cross-coupled" so that they are constrained to pivot in opposite directions relative to the forward stanchion **315**.

A fourth exercise apparatus constructed according to the principles of the present invention is designated as **400** in FIG. **4**. The apparatus has a frame **410** which includes an I-shaped base **412**; a forward stanchion or upright **415** which extends upward from the base **412** proximate a first end **413** thereof; and a rearward stanchion or upright **416** which extends upward from the base **412** proximate a second, opposite end **414** thereof.

Left and right flywheels **420** are rotatably mounted on opposite sides of the rearward stanchion **416** and rotate together about a common crank axis **426**. Those skilled in the art will recognize that the flywheels **420** may be connected to a conventional resistance device or replaced by

some other rotating member(s) which may or may not, in turn, be connected to one or more flywheels and/or a conventional resistance device.

Left and right foot supporting members **440** have rear ends which are rotatably connected to radially displaced portions of respective cranks **420**, thereby defining rotational axes **442**. The rotational axes **442** are constrained to rotate about the crank axis **426** and thereby define fixed crank radii.

An intermediate portion of each foot supporting member **440** is sized and configured to support a respective foot of a standing person. A forward end of each foot supporting member **440** is supported by a respective roller **450** which is rotatably mounted on an intermediate portion of a respective handle bar rocker link **470**. A lower end of each rocker link **470** is rotatably connected to the forward stanchion **415**, and an upper end of each rocker link **470** is sized and configured for grasping. Stops **417** are provided on the forward stanchion **415** to limit pivoting of the rocker links **470** relative thereto. This assembly also facilitates different types of exercises.

A fifth exercise apparatus constructed according to the principles of the present invention is designated as **500** in FIG. **5**. The apparatus has a frame **510** which includes an I-shaped base **512**; a forward stanchion or upright **515** which extends upward from the base **512** proximate a first end **513** thereof; and a rearward stanchion or upright **516** which extends upward from the base **512** proximate a second, opposite end **514** thereof.

Left and right flywheels **520** are rotatably mounted on opposite sides of the rearward stanchion **516** and rotate together about a common crank axis **526**. Those skilled in the art will recognize that the flywheels **520** may be connected to a conventional resistance device or replaced by some other rotating member(s) which may or may not, in turn, be connected to one or more flywheels and/or a conventional resistance device.

Left and right foot supporting members **540** have rear ends which are rotatably connected to radially displaced portions of respective cranks **520**, thereby defining rotational axes **542**. The rotational axes **542** are constrained to rotate about the crank axis **526** and thereby define fixed crank radii.

Each foot supporting member **540** has an intermediate portion which is sized and configured to support a respective foot of a standing person, and which is supported from beneath by a respective roller **550**. Each roller **550** is rotatably mounted on a distal end of a respective beam **554** having an opposite end rotatably connected to the forward stanchion **515**. A single actuator **555** is rotatably interconnected between the base **512** and an intermediate portion of the beam **554**. The actuator **555** is selectively operable to adjust the elevation of the roller **550** relative to the crank axis **526**.

Each foot supporting member **540** has a forward end which is rotatably and slidably connected to a respective handle bar rocker link **570**. In particular, on each side of the apparatus **500**, a pin **545** extends through a hole in the foot supporting member **540** and a slot **574** in the rocker link **570**. An intermediate portion of each rocker link **570** is rotatably connected to the forward stanchion **515**, and an upper end of each rocker link **570** is sized and configured for grasping.

Upper body exercise may be provided by other arrangements, as well. For example, handle bars may be pivotally mounted on the frame and movable independent of the foot supporting members and/or any underlying roller; or